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Using Cover Crops to Suppress Weeds and Improve Soil Health

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Cover Page Footnote

This work is supported by the U.S. Department of Agriculture National Institute of Food and Agriculture, Hatch project 1018005 and the NRCS KS-CIG grant NR196215XXXXG003. We are grateful to the producers for allowing us access to their fields.

Using Cover Crops to Suppress Weeds and Improve Soil Health

J.A. Dille, L. Chism, and G.F. Sassenrath

Summary

Herbicide-resistant weeds are creating challenges for producers to control weeds in crop fields. This study explores the potential of cover crops to reduce weed pressure and improve soil health. Cover crops were planted after corn harvest in tilled and no-till fields, and included Graza radish, winter wheat, annual ryegrass, spring oats, winter oats, and forage collards. The control was fallow with herbicide application but no cover crop. Soil health was determined prior to cover crop termination. Graza radish and forage collards did not grow consistently in all plots due to poor germination and winter kill. Significant weed biomass was produced in the fallow plot or in plots with poor cover crop stands. Microbial biomass was much greater in the no-till field than in the tilled fields.

Introduction

Weed management is a critical component of good crop production. Predominant use of herbicides for weed management has resulted in the evolution of herbicide-resistant weed species. Alternative practices are needed to control weeds. Cover crops have been reported to reduce weed pressure. Cover crops are also useful in increasing the diversity of plants grown in a field, and contributing to improved soil health. This study was designed to determine weed emergence and growth in the presence of cover crops across crop fields in southeast Kansas.

Experimental Procedures

Cover crops were planted in replicated blocks in one no-till field and two tilled fields in the fall and included: control (fallow with herbicide, no cover crop); winter wheat; Graza radish; annual ryegrass; winter oat; and forage collards. We also compared a mix of radish + ryegrass seed either by drilling or broadcast methods. Initially, there was a difference in cover crop emergence and stand establishment between the drilled and broadcast; however, that difference had disappeared by the spring due to winterkill of radish. We also compared spring oat and winter oat cover crops.

Plant biomass samples were taken in the fall (2019) approximately 45 days after cover crop planting and again in the spring (2020). Total plant biomass was harvested from each plot, weighed and dried. The Canopeo app (Patrignani and Ochsner, 2015) was used to measure canopy coverage in the spring. Forage quality of biomass was measured for acid detergent fiber, neutral detergent fiber, and protein. Soil samples were taken in the fall and in the spring and assayed for nutrients and biological activity.

In the spring (2020), weed emergence was monitored across all cover crop plots using permanent 1.32 in. PVC rings (Figure 1). Weed species were identified, counted, and pulled from each ring at several times prior to cover crop termination. Plant biomass samples of both cover crop and weed communities were taken in the spring prior to termination of the cover crops. Soybean was then planted across the experimental area as the cash crop. Soybean yields were measured at harvest.

Results and Discussion

High rainfall in the fall of 2019 reduced emergence of some cover crops. Other cover crops were chosen for their sensitivity to cold temperatures. Graza radish, spring oats, and forage collards were winter-killed. This is a strategy that will limit the requirement for early-season burn down prior to planting cash crops. Soil organic matter (%) increased in all fields after cover crops. The increase in organic matter was stronger with grass cover crops, including ryegrass, winter oats, and winter wheat. Significant differences in soil organic matter were observed between the tilled and no-till fields, with more organic matter in the no-till field. Averaged across all cover crops, there was a much greater increase in organic matter in the no-till field (0.17%) than in the tilled fields (0.1%). This indicates the importance of reducing tillage to preserve soil organic matter. Soil organic matter has been shown to increase the productive capacity of fields.

Biomass samples of the cover crops and weeds were taken mid-May of 2020, prior to termination of the cover crops. Graza radish at one tilled field and forage collards at another were winter-killed and did not produce any measurable biomass (Figure 3). Significant weed biomass was produced in the fallow (no cover crop plots) with 750 lb/acre in tilled field 1, 803 lb/acre in tilled field 2, and 1,026 lb/acre in the no-till field. In the winter-killed cover crop plots, weed biomass was 785 lb/acre in Graza radish plots at field 2, and 410 lb/acre in forage collard plots at field 1. Clearly, with no cover crop present, much higher weed biomass was produced. Most significantly, no measurable weed biomass was harvested from plots with any cover crop in any of the fields. Weed control by cover crops was excellent.

Conclusions

Cover crops are a potential alternative to chemical control for weed management. Establishment of the cover crop is important to ensure adequate weed control. Cover crop species that produced the most biomass and hence provided the best weed control across these three southeast Kansas environments included wheat, ryegrass alone or with radish, and winter oat covers. Depending on the conditions, radish or collards may freeze-out before winter and provide inadequate weed control.

Acknowledgments

This work is supported by the U.S. Department of Agriculture National Institute of Food and Agriculture, Hatch project 1018005 and the NRCS KS-CIG grant NR196215XXXXG003. We are grateful to the producers for allowing us access to their fields.

References

Patrignani, A. and Ochsner, T.E., 2015. Canopeo: A powerful new tool for measuring fractional green canopy cover. Agronomy Journal, 107(6), pp. 2312-2320. *https://doi.org/10.2134/agronj15.0150*.

Figure 1. Rings were installed in cover crop plots to track weed emergence and species.

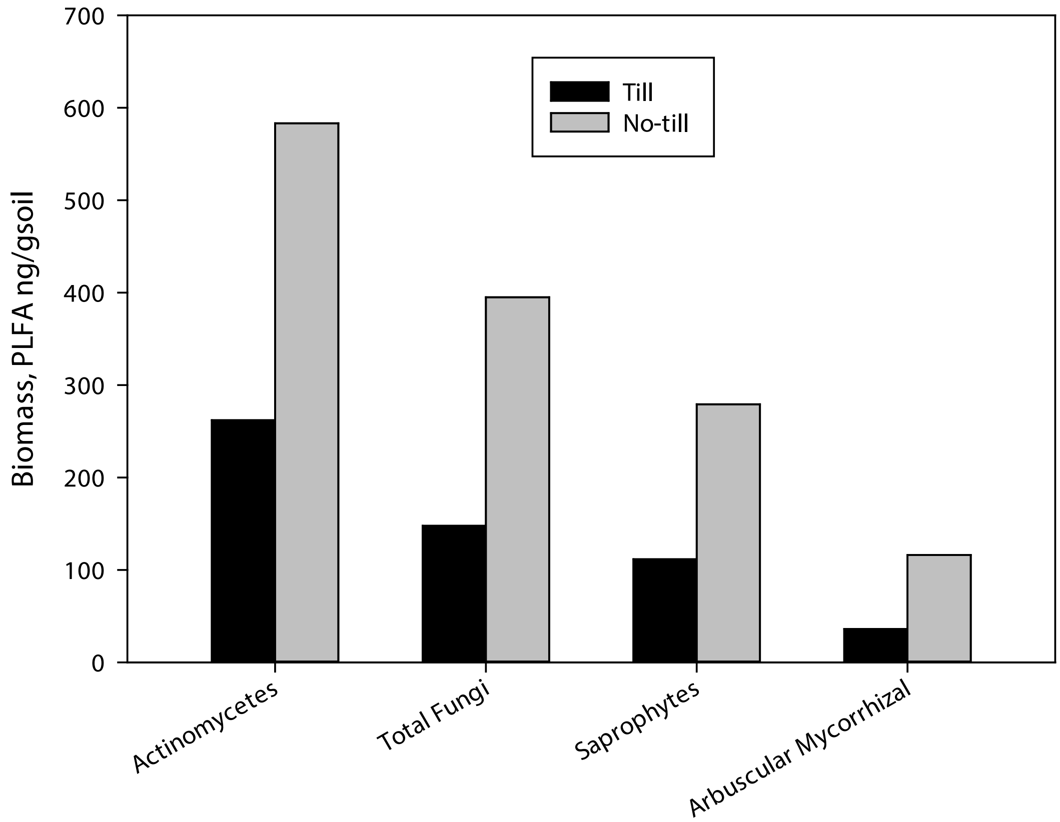

Figure 2. Differences in biological components between soils from till (dark grey) and no-till (light grey) crop production fields. PLFA = phospholipid fatty acid.

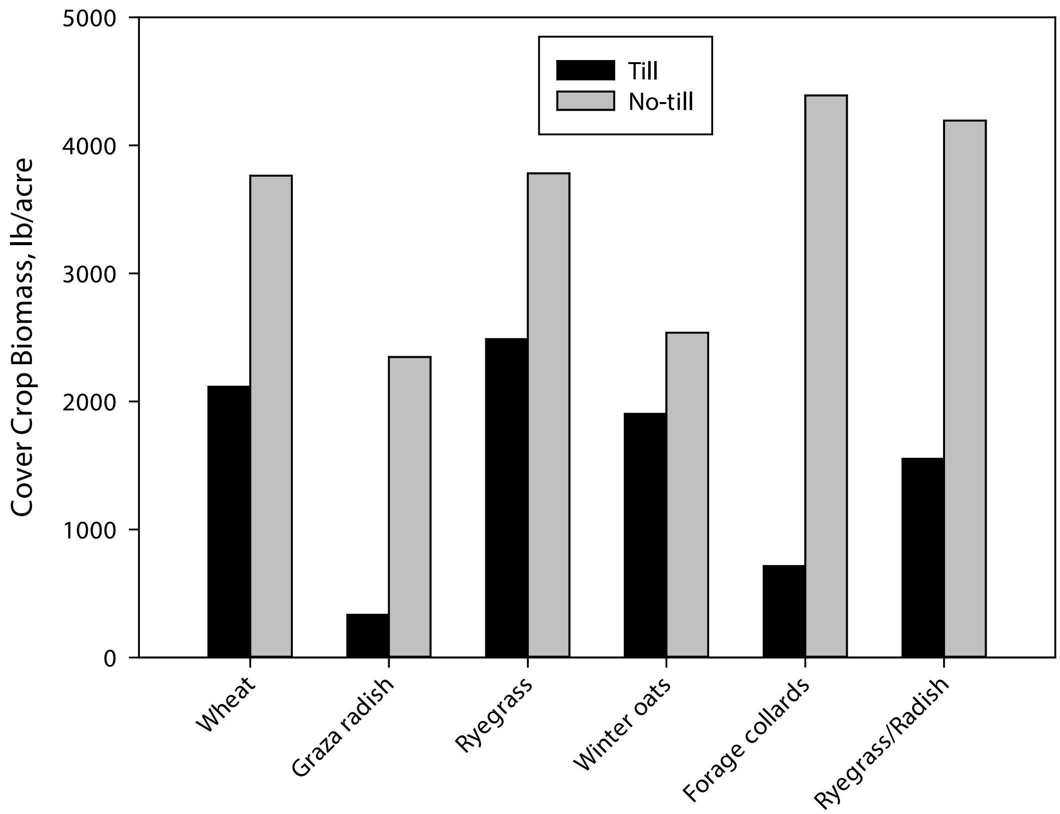

Figure 3. Cover crop biomass (lb/acre) produced by time of termination (May 18, 2020) in two tilled fields (dark grey) and one no-till field (light grey) in southeast Kansas. Cover crops were planted in the fall of 2019.